METHOD AND SYSTEM FOR CALL FORWARDING IN MULTIMEDIA TELECOMMUNICATION NETWORKS

FIELD OF THE INVENTION

[0001] The present invention relates generally to the art of telecommunication, and, more particularly, to a method and system for call forwarding in a multimedia telecommunication network.

BACKGROUND OF THE INVENTION

[0002] Wireless telecommunication networks allow mobile devices to communicate with each other and other networks, such as the Internet and the public switched telephone network. First and second generation wireless telephone systems are generally constrained in the amount of bandwidth available for communication. This limits capacity and also the types of services that can be provided. Third generation wireless systems, which are being developed through the 3rd Generation Partnership Project (3GPP), hold the promise of greater bandwidth, thereby increasing capacity and allowing for enhanced services, such as multimedia services. 3GPP is the new worldwide standard for the creation, delivery, and playback of multimedia over new, high-speed wireless networks. 3GPP enables the free sharing of multimedia files between a variety of devices, including cell phones, PDAs, and desktop computers. 3GPP devices include, in addition to a voice communication interface, capability for communication of data and display of data, including video.

[0003] Certain features are currently available to telephone service subscribers, including wireless subscribers. For example, select call forwarding is a service that automatically forwards calls from a selected set of numbers to a phone number of the subscriber's choice. Call forwarding services may also allow the subscriber to decide which

calls to receive. Typically, incoming calls to the subscriber's phone from the numbers preselected are rerouted to a phone number of the subscriber's choice, whether it's the subscriber's mobile, office, or other number. When call forwarding is activated, the subscriber's home phone may ring once with a short burst as a reminder that the call is being transferred. Further, busy call forwarding is a service that automatically forwards calls to another number when the subscriber's line is busy. Busy call forwarding eliminates missing a call when the line is in use. Typically, incoming calls to the subscriber's busy line are rerouted to a phone number of the subscriber's choice, whether it's the subscriber's mobile, office, or other number.

[0004] There is a need for a method and system that would allow a subscriber to send forward calls to multiple numbers, based upon the type of data being sent or other provisioned settings. Also, it is desirable to have a method and system in which a call may be forwarded to different destinations based on the type of data.

SUMMARY OF THE INVENTION

[0005] In accordance with one aspect of the invention, a method for method of forwarding calls for a subscriber having a primary communication device and a number of alternate communication devices in a multimedia telecommunication network is provided. The method includes storing a call forwarding profile for the subscriber's primary communication device in a network server, where the call forwarding profile specifies at least one of the alternate communication devices to which specific types of calls are to be forwarded, receiving a call for the subscriber's primary communication device from a caller, determining the type of the call that has been received, matching the type of call received to the call forwarding profile, and routing the call to the proper alternate communication device according to the call forwarding profile.

[0006] In accordance with another aspect of the invention, a system for forwarding calls for a subscriber having a primary communication device and a plurality of alternate communication devices in a multimedia telecommunication network is provided. The system includes means for storing a call forwarding profile for the subscriber's primary communication device at a network server, where the call forwarding profile specifies at least one of the alternate communication devices to which specific types of calls are to be forwarded, means for receiving a call for the subscriber's primary communication device from a caller, means for determining the type of the call that has been received, means for matching the type of call received to the call forwarding profile, and means for routing the call to the proper alternate communication device according to the call forwarding profile.

[0007] Still further advantages and benefits of the present invention will become apparent to those of ordinary skill in the art upon reading and understanding the present specification.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The invention may take form in various components and arrangements of components, and in various steps and arrangements of steps. The drawings are only for purposes of illustrating preferred embodiments and are not to be construed as limiting the invention.

[0009] FIG. **1** is a block diagram showing a known multimedia telecommunication environment suitable for implementing aspects of the present invention.

[0010] FIG. **2** is a flow chart illustrating a call forwarding process in accordance with an aspect of the present invention.

[0011] FIG. **3** is memory layout of data stored in the centralized database in accordance with an aspect of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0012] It is to be understood that the specific methods and systems illustrated in the attached drawings and described in the following specification are simply exemplary embodiments of the inventive concepts defined in the appended claims. Therefore, specific examples and characteristics related to the embodiments disclosed herein are not to be considered as limiting, unless the claims expressly state otherwise.

[0013] For simplicity and ease of reference, the acronyms listed below shall be used in the specification to refer to structural and/or functional network elements, relevant telecommunication standards, protocols and/or services, terminology, etc., as they are commonly known in the telecommunication art, except to the extent they have been modified in accordance with aspects of the present invention.

[0014] 3G – 3rd Generation

[0015] 3GPP – 3rd Generation Partnership Project

[0016] 3GPP2 – 3rd Generation Partnership Project 2

[0017] AAA – Authentication/Authorization/Accounting

[0018] AH – Address Handling

[0019] AS – Application Server

[0020] BGCF – Border Gateway Control Function

[0021] CCF – Call Control Function

[0022] CDMA – Code Division Multiple Access

[0023] CSCF – Call Session Control Function

[0024] HLR – Home Location Register

[0025] HSS – Home Subscriber Server

[0026] ICGW – Incoming Call Gateway

[0027] IMS – IP Multimedia Subsystem

[0028] IP – Internet Protocol

[0029] MGCF – Media Gateway Control Function

[0030] MGW – Media Gateway

[0031] MMT – Multimedia Terminal

[0032] MRFC – Multimedia Resource Function Controller

[0033] MRFP – Multimedia Resource Function Processor

[0034] PDN – Public Data Network

[0035] PLMN – Public Land Mobile Network

[0036] PSDN – Packet Switched Data Network

[0037] PSTN – Public Switched Telephone Network

[0038] PTT – Push-to-Talk

[0039] RAN – Radio Access Network

[0040] SIP – Session Initiation Protocol

[0041] SMS – Short Message Service

[0042] SMT – Single Media Terminal

[0043] SPD – Serving Profile Database

[0044] UMTS – Universal Mobile Telecommunications System

[0045] VOIP – Voice over IP

[0046] WLAN – Wireless Local Area Network

[0047] FIG. **1** is a block diagram of a known multimedia telecommunication network **10** suitable for implementation of aspects of the present invention. However, it is to be understood that other such networks may also be suitable. The multimedia telecommunication network **10** provides users with a variety of options for communication.

Users are able to transmit and receive multimedia communications, including audio, voice, video, and all types of data. The multimedia telecommunication network **10** provides access to data networks, such as the Internet, and public telephone networks, including wireless networks.

[0048] The multimedia telecommunication network **10** preferably includes an IP multimedia subsystem (IMS) **20**. The IMS **20** relates to a technology standardized by the 3rd Generation Partnership Project, also known as 3GPP, and it is also defined by 3GPP2 (3rd Generation Partnership Project 2). The IMS **20** is used to join mobile communication with IP technologies by adding the ability to deliver integrated voice and data services over the IP-based packet switched network. IMS services are based on the Session Initiation Protocol (SIP), which is the signaling protocol standard for next-generation 3GPP mobile wireless networks. The IMS **20** includes a number of system elements, such as a call session control function (CSCF) **22**, media gateways (MGW) **24**, a media gateway control function (MGCF) **26**, a border gateway control function (BGCF) **28**, a multimedia resource function processor (MRFP) **30**, a multimedia resource function controller (MRFC) **32,** a home subscriber system (HSS) **34** and application servers **36**. As is known in the art, the IMS **20** manages call sessions and provides and administers packet switching for multimedia communications within the network **10**.

[0049] A first communication device **40** is shown in FIG. **1**. The first communication device **40** may be a wireless device that includes a user interface and an interface for coupling to a radio access network (RAN) **42**. The user interface of the communication device **40** is typically referred to as terminal equipment and generally includes an audio interface, such as a microphone and speakers, a visual interface, such as a display, and a user input interface, such as a keyboard or touch pad. The interface for coupling to the RAN **42** is typically referred to as a mobile terminal and generally includes an over-the-air interface for

transmitting and receiving data. The over-the-air interface of communication device **40** is used to communicate with base stations in the RAN **42**. Preferably, the communication device **40** and the base stations in the RAN **42** communicate over-the-air using a packet-based protocol. A packet data subsystem (PDS) **44** couples the RAN **42** with the IMS **20** and the public data network (PDN) **52** in the usual manner.

[0050] A second communication device **50** is shown as a laptop or notebook computer operatively connected to the IMS **20** via the PDN **52**. The communication device **50** optionally employs a wireless local area network (WLAN) or wireline network, in the usual manner, to operatively connect to the PDN **52**. A third communication device **60** is shown as an ordinary telephone equipped to handle only voice communications. The communication device **60** is operatively connected to the IMS **20** via the public switched telephone network/public land mobile network (PSTN/PLMN) **62**.

[0051] Only three communication devices (**40, 50,** and **60)** are shown in FIG. **1** for the purpose of simplifying the diagram. However, it is to be appreciated that any number of such terminals are typically situated in the multimedia telecommunication network **10**. Additionally, while each is depicted as a specific type of communication device, other like terminals may also be incorporated.

[0052] With continuing reference to FIG. **1**, the bearer paths that carry (or relay) the communication traffic and/or user information for transmission from one terminal to another, which are known in the art, are shown as solid lines. Control paths carry associated signaling and/or control commands (or messages) to and between appropriate network elements for the purpose of managing and routing call sessions. The control paths are shown as dashed lines in FIG. **1**. Suitably, SIP and other known protocols are used on the control and bearer paths, respectively. For example, the known H.248 protocol is suitably employed for media gateway control. The CSCF **22**, the BGCF **28**, the MGCF **26**, the MRFC **32** and the AS **36**

comprise the call control and signaling functionality for the IMS **20**, while the bearer paths interface with the MRFP **30** and the MGW **24** to provide and support interconnectivity to external networks and/or subsystems, such as the PDS **44**, the PDN **52** and the PSTN/PLMN **62**.

[0053] The CSCF **22** supports and controls multimedia sessions. The CSCF **22** invites elements such as the MGCF **26** and the MRFC **32** to call sessions to control the establishment and maintenance of bearer paths for call sessions by adding, modifying or deleting appropriate bearer paths for respective call sessions. The CSCF **22** is the signaling entity for call session control. It manages sessions by using SIP and/or other appropriate call/session establishment protocols, and it provides features and services and coordinates with other network elements for session control, service control and resource allocation.

[0054] The CSCF **22** may provide the following functionalities: incoming call gateway, call control function, serving profile database, and address handling. By functioning as an incoming call gateway the CSCF **22** acts as a call session entry point and routes incoming calls. The call control function generally refers to call setup/termination and state/event management. The CSCF **22** interacts with the MGCF **26** for calls to/from the PSTN/PLMN **62** and with the BGCF **28** for calls to the PSTN/PLMN **62** to determine the appropriate MGCF **26** to use. It also controls the MRFP **30** via the MRFC **32**, which interprets information or signals coming from the CSCF **22** and controls the MFRP **30**, in order to support conferencing and other multi-party services. SIP level registrations from subscribers are processed with the call control function. The call control function may also provide service trigger mechanisms to the application servers **24** to invoke services provided thereby, either locally, at the application servers **24**, or elsewhere. It also reports call events for billing, auditing, intercept or other purposes, and may query the address handling function to check whether a requested communication is allowed given the current subscription. The

serving profiling database function refers to the interaction of the CSCF **22** with the HSS **34** to receive and cache user profile information. The address handling function refers to address analysis, translation, modification (when appropriate) and mapping.

[0055] The MGW **24** acts as a bearer path interface between the IMS **20** and externals networks and/or subsystems, and provides translation resources and resources for modifying the bearer stream (*e.g.*, encoding, transcoding, compression, packetization, depacketization, etc.). The bearer path elements include the MGCF **26**, the MRFC **32**, and the BGCF **28**. These elements provide the flexibility to add, modify or delete bearers used by the users' services. More particularly, the MGW **24** interacts with the MGCF **26**, which interprets signaling coming from the CSCF **22** and controls the MGW **24** to achieve resource allocation, bearer path control, and payload processing. The MGCF **26** communicates with the CSCF **22** in order to control the call state for media channels on one or more MGWs and performs conversions between Legacy and 3rd Generation (3G) Universal Mobile Telecommunications System (UMTS)/Code Division Multiple Access (CDMA) network call control protocols. Similarly, the MRFC **32** controls the media stream resources in the MRFP **30,** which also acts as a bearer path interface between the IMS **20** and external networks and/or subsystems, while being able to provide for conferencing or multiple party communications or other more advanced media services (relative to the MGW **24**). The BGCF **28** selects the proper MGCF **26**.

[0056] The HSS **34** is coupled to the CSCF **22** via a data link. The HSS **34** includes subscriber profile information, including information traditionally associated with a home location register (HLR) for a mobile subscriber. Suitably, the HSS **34** stores information such as user identification, user security information, including network access control information for authentication and authorization, user location information for user

registration and locating, and user profiles, including identification of the services subscribed to and other service specific information.

[0057] The application servers **36** are preferably coupled to the IMS **20** for use in interaction with the communication devices **40, 50, 60**. In particular, the CSCF **22** is coupled to the application servers **36** via a data link. Also, the HSS **34** is preferably coupled to the application servers **36**. A myriad of services and applications may reside in or be coupled to the application servers **36**, including a call forwarding method and system in accordance with the present invention.

[0058] In the preferred embodiment, the CSCF **22**, the MGCF **26**, the MGW **24**, the HSS **34**, and the application servers **36** are processor-based apparatus with data link interfaces for coupling together as described above and shown in FIG. **1**. These apparatus include one or more processors that execute programs to implement the functionality described herein and generally associated with 3GPP/3GPP2 wireless systems. The flexibility of these processor-based systems permits ready integration into these systems of a multimedia call forwarding method and system in accordance with the present invention.

[0059] In accordance with a preferred embodiment of the present invention, FIG. **2** shows a method **100** of forwarding multimedia calls to multiple destination numbers, based upon the type of data being sent or other provisioned settings. FIG. **2** is described below with reference to the network **10** of FIG. **1**, although the method 100 may be implemented in other compatible multimedia networks.

[0060] Initially, in step **101**, a wireless subscriber logs on to the first communication device **40**, which preferably supports wireless voice and data transmission as well as data push services (DPS) such as Instant Messaging (IM), which allows users to send messages to any of the people in their pre-selected contact list as long as that person is online, Short Message Service (SMS), which enables the transmission of alphanumeric messages between

mobile subscribers and external systems such as electronic mail, paging, and voice-mail systems, and Multimedia Messaging Service (MMS), which integrates the composition, storage, access and delivery of different kinds of media, *e.g.,* text, voice, image, animations, music or video.

[0061] Next, because the subscriber needs to leave his or her present location and communication device, the subscriber sets up a call forwarding profile, which is stored in a centralized database, such as at the HSS **34** or at an AS **36**. (step **102**). The centralized database includes a number of data sub-blocks for each subscriber. These are shown in FIG. **3**. They are shown as a super block **200**, not all of whose fields are filled for a particular subscriber. The super block, as known in the art, can be accessed from the identity of any one of several fields in the super block.

[0062] The super block **200** includes the following data sub-blocks: block **202** contains the subscriber's IM forwarding information; block **204** contains the subscriber's SMS forwarding information; block **206** contains the subscriber's MMS forwarding information, block **208** contains the subscriber's voice call forwarding information, and block **210** contains the subscriber's data call forwarding information. Of course, additional blocks may be provided in the super block **200** for storing additional subscriber data.

[0063] The call forwarding profile may be programmed in various ways, including through the subscriber's communication device **40** via an automated service or by entering a feature activation code (*e.g.*, *78), by logging on to the service provider's Internet Web site, or by calling a call center. The subscriber will generally want to forward the type of communication/media to the most convenient device available. Thus, the subscriber may want to submit a call forwarding profile along the lines of the following:

- Forward all IMs to the second communication device **50** (*e.g.*, this could be a mobile phone)

- Forward all SMSs to the second communication device **50** (*e.g.*, this could be the same mobile phone)
- Forward all MMSs to the third communication device **60** (*e.g.*, this could be a mobile phone with MMS capabilities or a laptop computer)
- Forward all other calls (*e.g.*, voice and data) to the second communication device **50** (*e.g.*, this could be the same mobile phone as above)

Of course, it is to be understood that other call forwarding profiles may be programmed, depending upon the devices and services available to the subscriber.

[0064] In step **103**, an incoming call having a unique destination address is received at the CSCF **22** in the traditional manner. Next, the CSCF **22** determines the type of call based upon media parameters that are contained in the incoming call request (*e.g.* ISUP (ISDN User Part) IAM (Initial Address Message) or SIP INVITE) (step **104**). These would indicate the "type of call," be it data, text, voice, etc. via existing media description parameters. The CSCF **22** then queries the HSS **34** to determine the appropriate destination number (*i.e.*, the appropriate communication device) for the call (step **105**) based on the type of media identified in the incoming call request. The HSS **34** looks up the call forwarding information for the unique destination address and media type and returns this information to the CSCF **22** (step **106**). The CSCF **22** routes the call to the appropriate destination address (step **107**).

[0065] The invention has been described with reference to the preferred embodiments. Obviously, modifications and alterations will occur to others upon reading and understanding the preceding detailed description of the preferred embodiments. It is intended that the invention be construed as including all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalence thereof.